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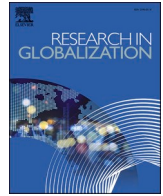
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The linkage between banking crisis and sovereign debt crisis: Evidence from Ghana

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ABSTRACT

This study investigates the effect of the recent Ghanaian banking crisis on the country's ongoing sovereign debt crisis. An Autoregressive Distributed Lag Model (ARDL) is adopted to estimate the immediate effects of Ghana's banking crisis on public debt levels using secondary data spanning the period of 1997–2022. The results show that causality flows from banking crisis to sovereign debt and not vice versa. The banking crisis has a positive significant effect on Ghana's sovereign debt levels. It also shows a significant negative relationship between Real GDP growth and public debt levels while private sector credit, and currency depreciation have a significant positive relationship with public debt levels in both the short run and long run. This study contributes to the doom loop literature by offering empirical and theoretical evidence of the linkage between banking crisis and sovereign debt crisis in a frontier economy. The study recommends promoting export diversification, strengthening financial sector regulations, enhancing institutional frameworks, and implementing effective debt management strategies to ensure economic stability.

1. Introduction

Banking crisis can have serious consequences for an economy's general health, especially as it pertains to sovereign debt. Generally, sovereign debt refers to the accumulated debt of a nation that includes both external and domestic obligations. Globally, studies posit that widespread bank failures or liquidity issues harshly stress the financial system of an economy (Laeven & Valencia, 2020; Royo, 2020; Taskinsoy, 2023). This leads to government interventions through deposit guarantees or bailouts to stabilize the banking sector resulting in increases in public debt levels. The unsustainability of the public debts usually leads to a sovereign debt crisis which intends lead to a worsened banking crisis as government borrowing costs rise and banks' balance sheets decline resulting in financial instability (James, 2024; Mitchener & Trebesch, 2021; Lewis & Dangerfield, 2021; Nguyen et al., 2022; Morelli et al., 2022). Most studies on the linkage of banking crisis and sovereign debt crisis have centred on developed and emerging economies (Brunnermeier et al., 2016; Hur et al., 2021; Gilchrist et al., 2022; Balteanu & Erce, 2018; Arellano et al., 2024). Like the developed and emerging economies, frontier economies like that of Ghana have their own peculiar economic and banking industry characteristics

(Quisenberry, 2018), hence, the need to examine the linkage between banking crisis and sovereign debt crisis in such a setting.

Aside the global perspective, countries in Africa, such as Ghana, have experienced notable major banking crises (Aryeetey & Ackah, 2011; Boako & Alagidede, 2018; Koh et al., 2020). For instance, prior to 2017, Ghana faced a severe banking crisis because of economic mismanagement and external debt burdens in 1983, whilst between 1999–2000 the banking crisis led to the collapse and restructuring of several financial institutions (Abotebuno Akolgo, 2023; Asravor, et al., 2023). The most noteworthy of the banking crises was the 2017–2019 banking crisis which led to a major financial sector clean-up exercise. The financial sector clean-up exercise initiated by the central bank (the Bank of Ghana, BoG), had the primary objective of safeguarding the stability of the financial sector whilst supporting Ghana's economic growth. As indicated by Dwamena and Yusoff (2022), Ghana's banking sector crisis has shaken the Ghanaian economy and plagued the financial sector into a state of uncertainty.

Banking and sovereign debt crises have profound consequences on individuals, businesses, and the nation. For individuals, these crises often lead to job losses, income instability, and a reduction in household wealth, exacerbating poverty and inequality. Businesses face increased

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borrowing costs, lower consumer demand, and disruptions to supply chains, which can lead to bankruptcies and a halt in investment. On a national scale, the banking and sovereign debt crises have resulted in economic contraction, inflation, and reduced public services due to the austerity measures implemented by the government of Ghana (GoG). Additionally, the sovereign debt crises have eroded the national credit ratings, limit access to international capital markets, and undermine investor confidence, further deepening the economic turmoil (Mutize & Nkhalamba, 2021). For instance, the international ratings agency, Fitch Ratings, downgraded Ghana's creditworthiness to further junk status in 2024.

Consequently, the clean-up resulted in 420 financial institutions' licences been withdrawn. The 420 institutions included 9 commercial banks, 23 savings and loan/finance house companies, 347 microfinance companies, 39 microcredit companies, 1 remittance company, and 1 leasing company. The total assets taken over for the 420 dissolved institutions was GHS 26.05bn (7.45 % of GDP). The GoG paid GHS 18.99bn (5.49 % of GDP) to reimburse impacted depositors' money, which included the construction of a bridge bank, the Consolidated Bank Ghana Limited.¹ The finance minister confirmed in March 2025 that over GHS 30.3bn (USD 2.06bn) had been spent by end of 2024 to address the sector's challenges. The finance minister stated that additional GHS 10.5bn will be needed to complete the clean-up.² As of the end of 2022, Ghana's overall public debt stood at GHS 88.8 % of GDP, a significant increase from 57 % of GDP in 2017 (IMF, 2023) with the expenditure from the financial clean-up significantly contributing to the country's debt burden.

According to Asravor et al. (2023), the precarious and increasing debt burden (both external and domestic debts) has led Ghana to be classified as weak sustainable debt country. The authors argued that it is therefore not surprising that the GoG launched the Domestic Debt Exchange Program (DDEP) on 5 December 2022 to address the unsustainable debt levels. Nevertheless, the IMF (2023) noted that DDEP poses a significant challenge to the stability of the financial sector in Ghana due to its impact on the exposure of financial institutions to government debt. Prior to the DDEP, banks, including state-owned banks, had substantial holdings of government securities, accounting for 30 % to 50 % of their total assets. However, because of coupon reductions and maturity extensions under the DDEP, the value of these assets is expected to decrease to approximately 70 % of their face value.³ This revaluation significantly shocked the balance sheets of these financial institutions. As a result, the 2022 audited financial statements published by 22 out of 23 commercial banks show that impairment charges for financial assets amounted to GHS 19.53bn (~USD 2.28bn),⁴ having a considerable effect on the profitability of the banks. This indicates the severe impact of the DDEP on the banking industry. Based on the published financials, the industry recorded a loss before tax of GHS 7.33bn (~USD 854.71m).⁵ Out of the 22 banks, five (5) did not meet the

prudential requirement of a minimum capital adequacy ratio (CAR) of 13 %.⁶ Likewise, the central bank reported a loss of GHS 60.8bn (~USD 7.09bn) and a negative equity position of GHS 55.1bn (~USD 6.42bn) in 2022.⁷ The finance minister stated in March 2025 that the Bank of Ghana is asking for a bailout of about GHS 53bn to address their negative equity position.⁸

The recent Ghanaian debt crisis as well as those of other African countries has provoked a significant number of publications. Empirical studies, such as those of Asravor et al (2023) and Abotebuno Akolgo (2023) have largely investigated the re-emergence of the indebtedness across the African continent. Despite this, a particular aspect of the Ghanaian debt which has not been explored empirically is the link between the country's 2017–2019 banking sector crisis and the current sovereign debt distress. The empirical evidence from Ghana, therefore, offers a compelling case study to unravel these intricate dynamics between bank crisis and sovereign debt crisis. To close this gap in the existing literature, the objective of the study is to investigate the relationship between banking sector crises and sovereign debt crises in Ghana. The questions that require the attention of further research and empirical investigation are:

What is the direction of causality between banking crisis and public debt?

What is the impact of the banking crisis on public debt?

What is the relationship between selected macroeconomic variables and the public debt level?

The research is significant because it contributes to the financial crisis and sovereign debt crisis literature in diverse ways: First, it is among the very few empirical attempts to explain the twin effect of the banking crisis and sovereign debt level in Sub-Saharan Africa and Ghana to be specific. In this study, we empirically examine the relationship between sovereign debt and macroeconomic indicators that have been reported in extant literature to influence a country's debt position (Asravor et al., 2023; Eijffinger and Karataş, 2023), incorporating these macroeconomic variables as control factors in our analysis. Also, this study provides empirical evidence on how disruptions in the banking sector can precipitate a sovereign debt crisis, thereby affecting the overall economic health of the nation. Given Ghana's history of banking sector vulnerabilities and rising public debts, this research is significant in highlighting the interdependencies between these two financial phenomena. The findings will offer valuable insights for policymakers, financial regulators, and stakeholders to develop strategies that can be adopted to mitigate the risks associated with banking and sovereign debt crises. Additionally, this study will contribute to the existing body of knowledge by providing a contextual analysis specific to Ghana, thereby offering a foundation for further research and policy development in similar frontier economies. The remainder of this paper is structured in this manner: Sections 2 and 3 explain the literature review and material & methods, respectively. Analysis of results are presented in Section 4 and conclusions are given in Section 5.

¹ <https://mofep.gov.gh/adverts/2022-09-27/request-for-expressions-of-interest-gh-mof-fsd-315018-cs-indv>.

² Government of Ghana. (2025). *The budget statement and economic policy of the government of Ghana for the 2025 financial year* (p. 20). Ministry of Finance.

³ The estimated reduction in Net Present Value (NPV) is derived from using a discount rate of 16% – 18%, which is the rate that most banks plan to adopt after consultations with the Institute of Chartered Accountants, Ghana (ICAG).

⁴ For most of the banks, the impairment charges reported in the P&L were not segregated into impairment charges on loans & advances and that on bonds arising from DDEP. For context, impairment charges on loans and advances in 2021 were ~GHS 1.3bn, accounting for 6.8% of the aggregate impairments reported in 2022. With the rising NPLs across the industry, hypothetically, impairment charges on loans and advances in 2022 could account for 10% – 20% of the aggregate impairment charges reported in 2022.

⁵ Based on the May 2023 MPC Press Release, the industry posted before-tax losses of GHS 8bn in 2022. This includes all the 23 commercial banks with one unpublished financial data included.

⁶ In calculating the Capital Adequacy Ratio (CAR), banks are permitted to allocate a portion of the losses incurred from the Debt Exchange Program (DDE) over a maximum period of four years, with a quarter of the losses recorded each year.

⁷ Bank of Ghana. (2022). Frequently asked questions (FAQs) on Bank of Ghana's 2022 published annual report and financial statements (p. 1).

⁸ <https://www.myjoyonline.com/bog-seeks-gh%E2%82%B553bn-bailout-to-address-financial-challenges-dr-forson/>.

2. Literature review

2.1. Theoretical literature review

The theoretical exploration of the linkage between banking crises and sovereign debt crises is sparse. According to the theoretical literature, the “doom loop phenomenon”⁹ best explains the relationship between the banking and sovereign debt crises. The theory contends that financial instability in banks exacerbates government budgetary problems, and vice versa. This cycle happens when the government provides considerable fiscal support such as liquidity support and deposit guarantee to alleviate a financial crisis. The consequent increase in public debts may raise borrowing rates and diminish the price of government bonds held on banks’ balance sheets, triggering more banking problems in a vicious cycle. Furthermore, the cycle can entail fiscal contraction, resulting in lower economic activity, more nonperforming loans, worsening banking position, and higher fiscal costs for bank recapitalization. (James, 2024; Capponi et al., 2022; Gómez-Puig & Sosvilla Rivero, 2024).

Nonetheless, fewer theoretical papers have identified mechanisms through which sovereign distress can lead to financial distress or vice-versa. For example, Acharya et al. (2014) offer a model demonstrating that when a sovereign becomes overburdened, the value of public guarantees it has issued declines, exacerbating financial distress due to the linkages between the government and the financial sector.

According to Eijffinger and Karataş (2023), another important theory regarding sovereign debt crisis is the “original sin” hypothesis which posits that a currency devaluation can trigger a sovereign default when a substantial portion of the debt is in foreign currency (Eichengreen & Hausmann, 2005; Jeanne, 2005). According to the “original sin” theory, developing countries are frequently unable to issue debt in their own currency, requiring them to borrow in foreign currencies. This causes a currency mismatch, resulting in susceptibility during currency depreciation, which can lead to sovereign debt crises owing to the increasing weight of foreign-denominated debt.

Also, an initial currency crisis is linked to a sovereign debt crisis through factors such as overvalued exchange rates (Jahjah & Montiel, 2003), a fall in the credit ratings (Reinhart, 2002), or a rise in international interest rates (Dreher et al., 2006). Equally, an initial sovereign default can lead to a currency crisis if the central bank implements expansionary monetary policies to avert a recession following the withdrawal of foreign capital.

2.2. Ghana sovereign debts situations

Abotebuno Akolgo (2023) argues that Ghana’s debts must be understood in the context of its political-economic history since independence, emphasizing structural factors and external limitations. These factors include the decline of developmental efforts in the 1970s, the implementation of Structural Adjustment Programmes in the 1980s, and a global lending system where Western creditors hold significant sway. Recent fiscal missteps by Ghana’s government have exacerbated these challenges.

As of 2022, the overall public debt of Ghana stood at GHS 88.8 % of the country’s GDP, compared to 57 % of GDP in 2017 (IMF, 2023). Increasing investor risk aversion due to heightened debt distress, according to Fitch (2022), caused Ghana’s spreads to expand. Bloomberg (2022) finds that there was a flight from the Ghanaian currency and bond markets, making the cedi the poorest performer in the world as it declined by more than 55 % in the first 10 months of 2022. Throughout the year 2022, investors consistently required a higher return on

investment for holding Ghana’s debt compared to the safer U.S. Treasuries. This yield spread, also known as the premium, remained above 1,000 basis points for most of the year. By December 2022, it had exceeded 3,000 basis points. Most of Ghana’s Eurobonds traded at a discount ranging from 60 % to 65 % of their face value in 2022, based on Chicago Board of Trade Bond Trading pricing compiled by Bloomberg (Fig. 1).¹⁰

Following the build-up of the country’s debt, the government announced the launch of DDEP on 5 December 2022 premised on a USD 3bn IMF bailout condition. According to the government, the broader objective of the domestic debt restructuring is to address the issue of public debt sustainability. Importantly, the completion of the first tranche of DDEP provided the government with substantial debt relief, amounting to nearly GHS 50bn in 2023 (IMF, 2023). Moreover, the government implemented additional debt exchanges for domestic debt denominated in US dollars and Cocobills issued by the Ghana Cocoa Board. Although these types of debt make up a small portion, approximately 5 %, of the total domestic debt, they carried a significant debt service obligation of around GHS 15bn in 2023. Moreover, the Ghanaian government announced on 19 December 2022 that it would temporarily halt all debt service payments for some of its external debts to allow for a systematic restructuring of those obligations. The suspension applied to several types of debt, such as Eurobonds (USD 13.2bn), commercial term loans, and most of its bilateral debt (USD 30bn total external debts affected). However, it does not include payments for multilateral debt, new debts, or debts related to short-term trade facilities.¹¹

Consequently, in January 2023, the Europe, Middle East and Africa (EMEA) Derivatives Committee, a committee affiliated with the International Swaps and Derivatives Association, determined that Ghana’s decision to halt debt payments on its Eurobonds, commercial term loans, and bilateral debt qualified as a “potential repudiation/moratorium.” Subsequently, in March 2023, the committee confirmed the occurrence of the credit event in Ghana, triggering the payment of credit default swaps as insurance coverage for the country’s sovereign debt. This ruling necessitated the disbursement of insurance protection, with credit-default swaps covering a total amount of USD 66.4m gross and USD 34.4m net as of 10 February 2023, according to data from the U.S. Depository Trust & Clearing Corporation.

In January 2024, the government agreed in principle to restructure USD 5.4bn in loans with official bilateral creditors. As of April 2024, the government has suggested to most bondholders of external debts a one-third reduction in the face value of their debt, together with restructured coupon payments of 5 % over the following three years and 7.5 % thereafter, until the new debt expires in the 2030s. In June 2024, Ghana and two bondholder groups agreed in principle to restructure the country’s USD 13bn debt with a potential 37 % principal haircut. Under the agreement, the bondholders will have to forgo claims worth approximately USD 4.7bn and provide liquidity relief of about USD 4.4bn within the scope of the existing IMF emergency aid plan that will expire in 2026.¹²

As indicated by Abotebuno Akolgo (2023), the recent accounts of Africa’s debt distress, though at the immediate can be attributed to the COVID-19 pandemic, Russia-Ukraine war, and fiscal indiscipline, the roots lie in economic subordination. While debt relief is crucial, comprehensive economic and financial reforms are indispensable moving forward.

¹⁰ <https://www.bloomberg.com/news/articles/2023-03-03/ghana-s-missed-interest-payment-sparks-default-insurance-payout#xj4y7vzkg>.

¹¹ Suspension of Payments on Selected External Debts of the Government of Ghana (December 2022), Ministry of Finance, Ghana.

¹² <https://www.myjoyonline.com/government-bondholders-reach-agreement-in-principle-to-restructure-13bn-debt-sources-say/>.

⁹ The term “doom loop” was first used by the Bank of England in 2009 to describe the potential for a vicious circle of negative feedback between the financial system and the real economy.

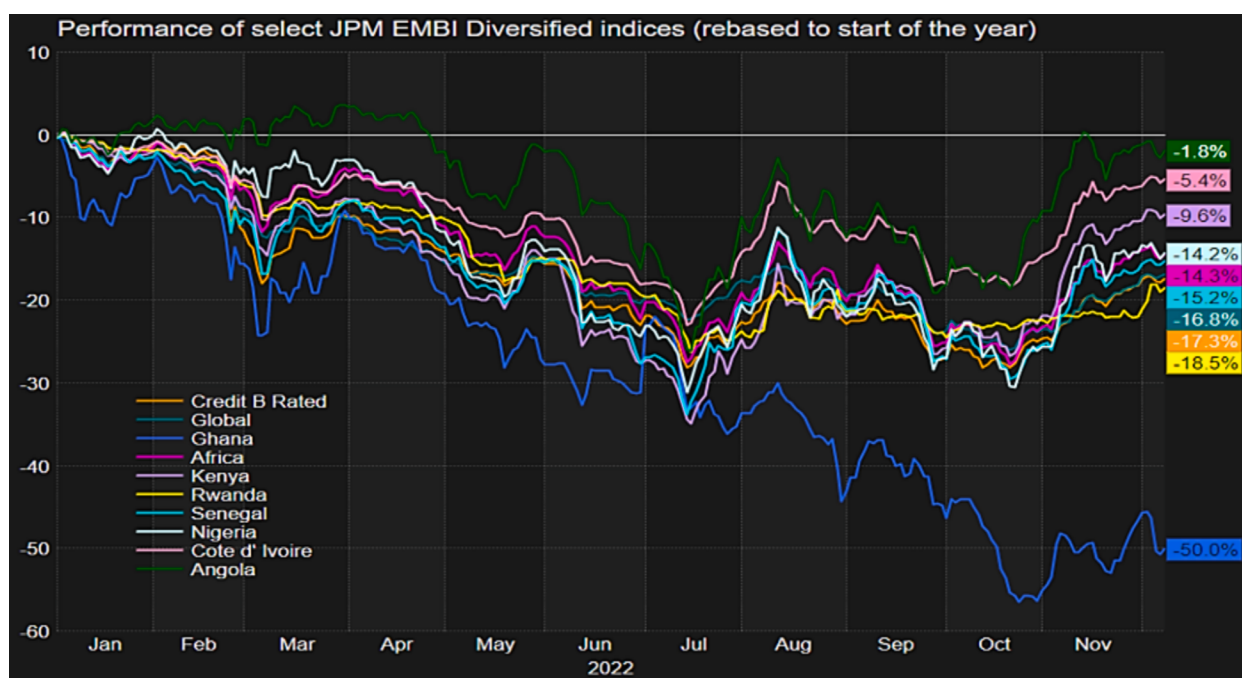


Fig. 1. Ghana's Eurobonds plummet compared to peers. Note. From "Explainer: Who holds Ghana's debt and what restructuring is planned?" by K. Strohecker, 2022. (<https://www.reuters.com/world/africa/who-holds-ghanas-debt-what-restructuring-is-planned-2022-12-09/>). Copyright 2023 by Reuters.

2.3. Empirical literature review

Generally, most empirical studies have reported a positive relationship between bank crisis and sovereign debt crisis. For instance, Capasso et al. (2022), investigate the transfer of bank-sovereign risk between eurozone countries. By employing a Global Vector Autoregressive (GVAR) approach to compute the cross-country "distance" in the debt-to-GDP ratio, the authors find a sovereign-bank loop as a shock in one country's credit default swap (CDS) spreads to other eurozone countries exacerbating the sovereign risks. Despite the insight, however, the focus of the authors was on Eurozone countries limiting the generalizability of the findings to emerging and frontier economies, where financial systems are often more fragile, and government interventions are more frequent.

Moving a step further by including currency crisis, Eijffinger and Karataş (2023) examine the linkages between sovereign debt, currency crises, and banking crises from 1985 to 2020. Their findings reveal that banking crises typically occur before sovereign defaults, and not vice versa. Also, they find that short-term external debt incurred during banking crises, combined with misaligned exchange rates, underlined by currency crises, tends to elevate the probability of future sovereign defaults. While this conclusion aligns with the literature, their study does not explore the reverse causality, that is, whether sovereign debt crises can lead to banking crises, particularly in developing economies like Ghana.

In another study, Kalemli-Özcan, et al. (2016) investigate the banking and sovereign debt crises by extending the study to focus on four (4) countries, particularly in Greece, Ireland, Portugal, and Spain. The paper by exploring the impact of bank losses, fiscal deficits, and anticipated debt haircuts on bank solvency finds that market-implied default probabilities differentiate between countries based on five criteria. However, this analysis primarily targets advanced economies, and the impact of similar factors in Sub-Saharan Africa remains under-explored. Hoque et al. (2015) analyze whether regulation reduced risk during the credit crisis and the sovereign debt crisis for a cross-section of global banks. By employing data from the World Bank survey, the researchers find that regulatory restrictions, official supervisory power, capital stringency, along with private monitoring explain bank risk in

both crises. Additionally, the researchers find more risk accelerated the sovereign debt crisis. Erce (2012) analyses 11 cases of sovereign defaults cross diverse countries and finds that liquidity pressures, banking system robustness, and corporate sector reliance on capital markets explained observed discrimination patterns. Thus, Erce (2012) shows that sovereign defaults can be designed to minimize their impact on domestic banks. Although his study emphasizes key structural determinants of sovereign defaults, the relationship between these factors and banking crises is not well-defined, particularly in the context of the banking sectors in developing economies.

In terms of other macroeconomic variables, Asravor et al. (2023) using data from 1994 to 2018 in Ghana reveal a substantial crowding-in effect between domestic debt and private sector credit and investment. Mbate (2013) posits that domestic debt has a negative elasticity of 0.3 percent of GDP, and crowding out was perceived as an obstacle to the accumulation of capital and the growth of the private sector and the economy. Memon et al (2015) examine how firm-specific, macroeconomic factors and firm heterogeneity affect debt levels in Pakistan's non-financial listed firms. Using static panel data models, including pooled OLS and fixed effects, they find that profitability, tangibility, size, interest rates, and inflation significantly impact debt levels.

Despite the valuable insights from these studies, a gap exists in the empirical literature regarding the bidirectional relationship between banking crises and sovereign debt crises in frontier economies, such as Ghana. While previous research has predominantly focused on advanced economies or specific crises in isolation, there is limited understanding of how these crises interact in a developing economy with a fragile financial system. This study aims to fill this gap by empirically testing the linkages between banking crises and sovereign debt crises in Ghana, with a focus on their bidirectional causality and transmission mechanisms.

3. Materials and methods

3.1. Sources of data

The primary data sources for this study are the Bank of Ghana, the International Monetary Fund (IMF), Bloomberg and the World Bank.

The study employs secondary data covering a period of 26 years, from 1997 to 2022. Specifically, data on public debt-to-GDP (debt_gdp) was obtained from the IMF, while information on banking crises (bnk_cris) was sourced from the Bank of Ghana. The Inflation (inf_avg) and the real GDP growth (real_gdp) data were retrieved from the IMF. The banking industry's loan-to-deposit ratio (ld) data was sourced from the Bank of Ghana, and real sector growth (ciea) was measured using the Bank of Ghana's Composite Index of Economic Activity (CIEA). Data on currency depreciation rate (USD/GHS) (curr_dep) was sourced from Bloomberg. The private sector credit-to-GDP (psc_gdp) and the claims on the central government (% GDP) (ccg_gdp) data were sourced from the World Bank.

3.1. Definition of variables

To examine the relationship between banking crises and sovereign debt in Ghana, the dependent variable used is the public debt-to-GDP ratio (debt_gdp), while the independent variable is banking crisis (bnk_cris). The independent variable, banking crisis (bnk_cris), is measured as a dummy variable (1 if a crisis occurred, 0 otherwise) and is expected to have a positive sign with public debt, as banking crises typically lead to increased debt. Inflation (inf_avg) is measured as the average inflation rate over the period and is expected to have a positive sign, as higher inflation may drive higher sovereign debt due to increased government borrowing. Real GDP Growth (real_gdp), measured as annual percentage growth in real GDP, is expected to have a negative sign, as higher growth reduces borrowing needs. Banking Industry's Loan-to-Deposit Ratio (ld) is measured as the ratio of loans to deposits and is expected to have a positive sign, indicating that higher ratios may signal increased banking sector risk, leading to higher sovereign debt. Real Sector Growth (ciea), measured by the Bank of Ghana's Composite Index of Economic Activity, is expected to have a negative sign, as stronger growth reduces government borrowing. Currency Depreciation Rate (USD/GHS) (curr_dep), measured as the annual depreciation of the Ghanaian cedi against the US dollar, is expected to have a positive sign, as depreciation increases the cost of foreign debt. Private Sector Credit-to-GDP (psc_gdp), measured as the ratio of private sector credit to GDP, is expected to have a negative sign, as a well-developed private credit market reduces government borrowing. Finally, Claims on the Central Government (% GDP) (ccg_gdp), measured as the ratio of claims on the central government to GDP, is expected to have a positive sign, as higher claims indicate increased government borrowing, raising sovereign debt.

3.2. Model specification and estimation strategies

3.2.1. Granger-Causality test

To answer the first research question of the direction of causality, we test the Granger causality between bank crises and sovereign debt crises by specifying a Vector Autoregression (VAR) model. This enables us to examine the dynamic relationship between these two variables over time. The first model specified is the sovereign debt crisis as specified in equation (1):

$$\text{debt_gdp}_t = \alpha_0 + \sum_{i=1}^p \alpha_i \text{debt_gdp}_{t-i} + \sum_{j=1}^q \beta_j \text{bnk_cris}_{t-j} + \varepsilon_t \quad (1)$$

The second autoregressive model specification for the banking crisis is presented in equation (2):

$$\text{bnk_cris}_t = \gamma_0 + \sum_{i=1}^p \gamma_i \text{bnk_cris}_{t-i} + \sum_{j=1}^q \delta_j \text{debt_gdp}_{t-j} + \varepsilon_t \quad (2)$$

Where debt_gdp and bnk_cris represents the sovereign debt crisis indicator and the bank crisis indicator at time t, respectively; α_0 and γ_0 are the constant term; α_i and γ_i are coefficients for the lagged values of sovereign debt and bank crisis, respectively; β_j and δ_j are the coefficient of the of sovereign debt and bank crisis, respectively; and ε_t and ε_t are the error terms of sovereign debt and bank crisis, respectively. We test

for Granger causality by evaluating the significance of the lagged coefficients. Specifically, by performing the F-tests to test the null hypotheses:

$$H_{0, \text{bnk_cris} \rightarrow \text{debt_gdp}} : \beta_1 = \beta_2 = \dots = \beta_q = 0$$

$$H_{0, \text{debt_gdp} \rightarrow \text{bnk_cris}} : \beta_1 = \beta_2 = \dots = \beta_q = 0$$

Rejecting $H_{0, \text{bnk_cris} \rightarrow \text{debt_gdp}}$ indicates that bank crises Granger-cause sovereign debt crises, while rejecting $H_{0, \text{debt_gdp} \rightarrow \text{bnk_cris}}$ indicates that sovereign debt crises Granger-cause bank crises.

3.2.2. Impact of banking crisis, selected macroeconomics variables on sovereign debt

To examine the impact of banking crisis and selected macroeconomic variables on sovereign debt crisis, we developed and estimate two main models, the first model is without covariates (selected macroeconomic variables) whereas the second model is estimated with selected covariates. The estimated econometric model(s) are presented in equation (3) and (4) as follows:

$$\text{debt_gdp}_t = \beta_0 + \beta_1 \text{bnk_cris}_t + \varepsilon_t \quad (3)$$

$$\text{debt_gdp}_t = \beta_0 + \beta_1 \text{inf_avg}_t + \beta_2 \text{real_gdp}_t + \beta_3 \text{psc_gdp}_t + \beta_4 \text{ccg_gdp}_t + \beta_5 \text{ld}_t + \beta_6 \text{ciea}_t + \beta_7 \text{curr_dep}_t + \beta_8 \text{bnk_cris}_t + \varepsilon_t \quad (4)$$

The variable definition in Equation (1) has been presented in Section 3.1. According to the empirical studies of Balteanu and Erce (2018), the banking sector's claims on government, credit to the private sector, government debt, real GDP growth, and portfolio capital inflows influence sovereign debts in emerging markets.

To examine this relationship, the study employs the autoregressive distributed lag model (ARDL) suggested by Pesaran et al. (2001), for co-integration investigation (time series data) and error correction (short run) analysis. The choice of the ARDL was because the initial unit root test showed different orders, thus, some of the variables were integrated in order 1 (I(1)) whereas other variables were not. Thus, the ARDL model is particularly useful when dealing with non-stationary time series data at different levels (Asravor & Fonu, 2021).

Furthermore, the choice of the ARDL was because it allows for the inclusion of both lagged values of the dependent variable and lagged values of the independent variables. Except for the bank crises variable, the study employed a log transformation of the variables and presents the equation as follow (equation (5) and (6):

$$\log(\text{debt_gdp}_t) = \beta_0 + \beta_1 (\text{bnk_cris}_t) + \varepsilon_t \quad (5)$$

$$\begin{aligned} \log(\text{debt_gdp}_t) = & \beta_0 + \beta_1 \log(\text{inf_avg}_t) + \beta_2 \log(\text{real_gdp}_t) + \beta_3 \log(\text{psc_gdp}_t) \\ & + \beta_4 \log(\text{ccg_gdp}_t) + \beta_5 \log(\text{ld}_t) + \beta_6 \log(\text{ciea}_t) \\ & + \beta_7 \log(\text{curr_dep}_t) + \beta_8 \text{bnk_cris}_t + \varepsilon_t \end{aligned} \quad (6)$$

4.1. Presentation of results

4.1.1. Unit root test

The first test performed was the unit root test using the Augmented Dickey Fuller (ADF), Phillip Perron (PP) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test. Upon conducting a thorough analysis of the variable parameters presented in Equation (1), it becomes apparent that there is a strong indication of the presence of a unit root in the level of some of the variables whereas others were stationary at levels. For instance, the ADF shows that Ciea and curr_dep was significant at levels (integrated at the level I (0)) whilst the PP test shows that the banking crisis was significant at levels. However, after employing the technique of first differences (Table 1), it is observed that most of the variables exhibit stationarity.

Table 1
Unit Roots and Stationarity tests.

		In Level	First Difference
debt_gdp	Drift	−0.6521 (2) [0.52100]	−2.9697 (2) [0.00757]**
	ADF Trend	−0.8357 (3) [0.41300]	−3.4893 (3) [0.00245]**
	None	0.6612 (2) [0.51500]	−2.9650 (2) [0.00739]**
	PP Constant	−0.5783 (1) [0.53100]	−4.2842 (1) [0.60400]
inf_avg	Trend	−0.8541 (2) [0.34900]	−4.3831 (2) [0.38700]
	KPSS Constant	0.30060 (2)***	0.15210 (8)
	Trend	0.2070 (2)	0.26820 (8)***
	Drift	−2.2190 (2) [0.03760]	−3.7059 (2) [0.001400]**
real_gdp	ADF Trend	−1.8925 (3) [0.07300]	−3.6981 (3) [0.001530]**
	None	−0.5692 (2) [0.57500]	−3.8714 (2) [0.000883]***
	PP Constant	−3.1337 (1) [0.14000]	−6.1191 (1) [0.09200]
	Trend	−2.8995 (2) [0.27970]	−6.1936 (2) [0.08160]
pse_gdp	KPSS Constant	0.3424 (2)***	0.2345 (2)***
	Trend	0.1415 (2)**	0.0750 (2)***
	Drift	−2.4502 (2) [0.02310]	−3.8890 (2) [0.000912]***
	ADF Trend	−2.3802 (3) [0.02740]	−3.8453 (3) [0.001090]**
ld	None	−0.9303 (2) [0.36200]	−3.9856 (2) [0.000673]***
	PP Constant	−3.3617 (1) [0.10621]	−6.9891 (1) [0.00000]
	Trend	−3.2844 (2) [0.11302]	−6.8749 (2) [0.00000]
	KPSS Constant	0.1241 (2)***	0.0668 (2)***
ciea	Trend	0.1239 (2)**	0.0521 (2)***
	Drift	−2.4790 (2) [0.02170]	−3.7578 (2) [0.002140]**
	ADF Trend	2.3802 (3) [0.02740]	−4.0300 (3) [0.000715]***
	None	0.1281 (2) [0.89900]	−3.8879 (2) [0.000849]***
curr_dep	PP Constant	−2.8645 (10) [0.007188]**	−7.2209 (10) [0.047930]
	Trend	−2.3575 (10) [0.020210]*	−8.1943 (10) [0.01490]*
	KPSS Constant	0.4424 (2)**	0.3057 (2)***
	Trend	0.1973 (2)	0.0513 (2)***
ld	Drift	−1.9332 (2) [0.06680]	−2.8521 (2) [0.009850]**
	ADF Trend	−2.4613 (3) [0.02310]	−3.0200 (3) [0.007040]**
	None	−0.4182 (2) [0.68000]	−2.9098 (2) [0.008380]**
	PP Constant	−1.9897 (2) [0.10900]	−3.7747 (1) [0.27460]
ciea	Trend	−2.2266 (1) [0.03950]	−4.2058 (2) [0.16990]
	KPSS Constant	0.2474 (2)***	0.3422 (2)***
	Trend	0.2027 (2)	0.0461 (2)***
	Drift	−2.6690 (2) [0.01440]*	−5.0829 (0) [0.000057]***
curr_dep	ADF Trend	−2.4475 (3) [0.02370]*	−5.2498 (1) [0.000046]***
	None	−1.5910 (2) [0.12600]	−5.2142 (0) [0.000036]***
	PP Constant	−3.8921 (2) [0.42890]	−8.6452 (1) [0.02056]
	Trend	−3.7181 (2) [0.72940]	−8.9714 (2) [0.01840]
curr_dep	KPSS Constant	0.1838 (2)***	0.1625 (2)***
	Trend	0.1788 (2)	0.0560 (2)***
curr_dep	Drift	−1.0577 (2) [0.7158]	−3.7354 (0) [0.0101]
			**

Table 1 (continued)

		In Level	First Difference
debt_gdp	ADF Trend	−2.4771 (3) [0.3353]	−3.6817 (1) [0.0436]
	None	−0.2184 (2) [0.5975]	−2.0939 (0) [0.0372]
	PP Constant	−1.0737 (1) [0.7097]	−3.7207 (1) [0.0104]
	Trend	−2.3921 (2) [0.3742]	−3.6677 (2) [0.0448]
crg_gdp	Drift	−1.0302 (2) [0.31500]	−3.4585 (2) [0.002480]**
	ADF Trend	0.6916 (3) [0.49700]	−3.9093 (3) [0.000943]***
	None	0.2985 (2) [0.76810]	−3.5137 (0) [0.002060]**
	PP Constant	−2.0967 (1) [0.00363]	−6.9579 (1) [0.06577]
bnk_crisis	Trend	−1.8652 (2) [0.00339]	−7.3708 (2) [0.04100]*
	KPSS Constant	0.1701 (2)***	0.2304 (2)***
	Trend	0.1700 (2)	0.0747 (2)***
	ADF Drift	n.a.	n.a.
bnk_crisis	Trend	n.a.	n.a.
	None	n.a.	n.a.
	PP Constant	−2.0805 (1) [0.00914]**	−3.7540 (1) [1.0000]
	Trend	−2.9200 (2) [0.09520]	−3.6458 (2) [0.79750]
bnk_crisis	KPSS Constant	0.3426 (8)***	0.1014 (2)***
	Trend	0.1150 (2)***	0.0429 (2)***

Note. ***, ** or * denote statistical significance at 1%, 5% or 10%; In () the number of lags or bandwidth; In [] the p-value.

Since the model's variables consist of a combination of first difference and level series, the Autoregressive Distributed Lag (ARDL) methodology is appropriate for long-run analysis (Pesaran et al., 2001).

4.1.2. Granger causality test

Table 2 shows that with a lag length of 4, the Pairwise Granger Causality Tests reveal that there is no significant evidence that the sovereign debt crisis (debt-to-GDP ratio) does not granger-cause banking crises (BNK_CRIS), as indicated by the probability value (0.9385).

Conversely, with a probability value of 0.0026, the second null hypothesis indicates that banking crises (BNK_CRIS) do granger-cause changes in the sovereign debt (debt_gdp). The finding suggests a significant Granger causality from banking crises to sovereign debt but not vice versa. Specifically, banking crises are significant predictors of future changes in sovereign debt.

4.1.3. ARDL bound test

Based on the values of the ARDL Bounds Test presented in the Table 3, the F-statistic values of 5.443916 and 3.986221 for both model with covariates and without covariates are significant at 1 % and 5 % respectively. This implies a rejection of the null hypothesis and confirmation of the long run cointegration and signifies that model equations are cointegrated at 1 % and 5 % respectively.

The unit root test and ARDL bounds testing procedures confirm that the study variables exhibit significant cointegrating relationships. As a result, the study model is suitable for analyzing both long-run relationships and short-run dynamics through error correction.

Table 2
Pairwise granger causality tests.

Null hypothesis	Obs	F-statistic	Prob.
DEBT_GDP does not Granger Cause BNK_CRIS	22	0.19168	0.9385
BNK_CRIS does not Granger Cause DEBT_GDP		7.28600	0.0026

Table 3
ARDL Bounds Test.

Test Statistic	Value	Signif.	I(0)	I(1)
Model without covariates	3.986221	10 %	3.02	3.51
F-statistic				
K	1	5 %	3.62	4.16
		2.5 %	4.18	4.79
Model With Covariates				
F-statistic	5.443916	10 %	1.66	2.79
K	8	5 %	1.91	3.11
		2.5 %	2.15	3.4
		1 %	2.45	3.79
F-Bounds Test	Null Hypothesis: No levels relationship			

4.1.4. Estimated long-run effects

The long run analysis of the co-integration relationship between sovereign debt and bank crisis shows that without other covariates, there is a positive relationship between bank crisis and sovereign debts (0.329993) after the third integration (Table 4). The Akaike information criterion (AIC) explains approximately 89.4 % of the variance in the sovereign debts whilst the model explaining power (adjusted R-squared) was 83.1 %.

The long-run co-integration relationship between sovereign debt and the explanatory variables with covariates using ARDL(1, 0, 1, 1, 1, 0, 1, 0) using the trend and constant bound test, shows that the Akaike information criterion (AIC) explains approximately 96.70 % of the variance of sovereign debt, with an adjusted R-squared of 92.78 %. More importantly, the bank crisis (BNK_CRIS) has a significant positive effect on sovereign debts by 36.90 %. Also, the lag of sovereign debts (LOG

(DEBT_GDP)) was positive and significant indicating that about 67.42 % of the current year's debts were explained by the previous year's debt. Other covariates, such as private sector credit (LOG(PSC_GDP)), and the lag of Bank of Ghana Composite Index of Economic (CIEA(-1)) had a positive significant impact on sovereign debts. Table 4 show further shows a long-run negative relationship between real gross domestic product (LOG(REAL_GDP)) and the lagged value of real gross domestic product (LOG(REAL_GDP)), currency depreciation (LOG(CURR_DEP)), and banking industry loan-to-deposit ratio (LD).

4.1.5. Error correction model (ECM)

The error correction term (ECT) signifies the rate at which equilibrium is restored in the dynamic model. The ECM term must meet two criteria, that is, it must be statistically significant and have a negative sign (Asravor & Fonu, 2021).

Table 5 presents the short-run coefficient estimates from the error correction ECM version of the ARDL model. In the model, the negative significant value of ECT of 0.459 suggest that the speed of adjustment to the long run of sovereign debt is approximately 46 % for the model without covariates (bank crisis and sovereign debt). The introduction of other variables or covariates decreased the speed of adjustment to the long run to 0.3258. Thus, suggests that the speed of correcting long-run deviations is approximately 32.58 percent in subsequent periods. Also, the coefficients in the short-run model (with and without covariates) suggest that BNK_CRIS significantly influences sovereign debt (LOG (DEBT_GDP)) at 5 % significant level. Also, variables such as CURR_DEP, CCG_GDP, and REAL_GDP were significant in the model without covariates.

Table 4
Long-run Estimates of banking crisis and sovereign debt crisis.

Variable	Estimate without Covariate		-	Estimate with Covariate	
	Coefficient	Std. Error		Coefficient	Std. Error
LOG(DEBT_GDP(-1))	0.771075***	0.127925		0.674166***	0.127355
LOG(DEBT_GDP(-2))	0.108104				
LOG(DEBT_GDP(-3))	0.020695				
LOG(DEBT_GDP(-4))	-0.358875***	0.191426			
BNK_CRIS	0.092145	0.140741		0.369082***	0.118797
BNK_CRIS(-1)	0.106339				
BNK_CRIS(-2)	-0.026491				
BNK_CRIS(-3)	0.329993**				
LOG(CCG_GDP)				0.217694**	0.093995
LOG(CCG_GDP(-1))				-0.223350*	0.108293
CIEA				0.005507	0.004436
CIEA(-1)				0.013105***	0.004054
LOG(CURR_DEP)				1.047314	0.553649
LOG(CURR_DEP(-1))				-1.518300**	0.523769
LOG(INF_AVG)				0.019446	0.108850
LOG(INF_AVG(-1))				-0.141484	0.103536
LOG(PSC_GDP)				1.112767***	0.196687
LOG(REAL_GDP)				-0.047684***	0.012895
LOG(REAL_GDP(-1))				-0.057776***	0.016592
LD				-0.015134**	0.004510
C	1.657160***	0.515479			
R-squared	0.894242			0.966930	
Adjusted R-squared	0.830786			0.927847	
S.E. of regression	0.171065			0.111705	
Sum squared resid	0.438951			0.137257	
Log likelihood	15.05458			29.58623	
Mean dependent var	3.825761			3.825761	
S.D. dependent var	0.415858			0.415858	
Akaike info criterion	-0.404367			-1.246898	
Schwarz criterion	0.083184			-0.564328	
Hannan-Quinn criter.	-0.269141			-1.057582	
Durbin-Watson stat	1.852315			2.409044	

***, ** or * denote statistical significance at 1 %, 5 % or 10 %

Table 5
Error Correction Model.

Model without Covariate			Model with covariate		
Variables	Coef.	Std. Error	Variables	Coef.	Std. Error
DLOG(DEBT_GDP(−1))	0.230075	0.178528	DLOG(DEBT_GDP(−1))	0.325834**	0.127355
DLOG(DEBT_GDP(−2))	0.33818*	0.179312	D(BNK_CRIS)	1.132729**	0.479032
DLOG(DEBT_GDP(−3))	0.358875*	0.175092	DLOG(CGG_GDP)	0.217694***	0.051999
D(BNK_CRIS)	0.092145	0.115205	D(CIEA)	0.005507**	0.001917
D(BNK_CRIS(−1))	−0.3035**	0.143086	D(DEP_CURR_LOG)	1.047314***	0.209038
D(BNK_CRIS(−2))	−0.32999**	0.140104	DLOG(INF_AVG)	0.019446	0.045742
CointEq(−1)*	−0.459	0.123566	D(REAL_GDP)	−0.047684**	0.007112
			D(LD)	−0.046447**	0.018909
			CointEq(−1)*	−0.325834***	0.035419

***, ** or * denote statistical significance at 1 %, 5 % or 10 %

4.2. Discussions of results

4.2.1. Causality between banking crisis and Ghana's public debt

The findings show that Ghana's banking crises are significant predictors of sovereign debt levels which implies that banking sector instability leads to increase in Ghana's sovereign debt. This causality highlights a critical vulnerability within the Ghanaian economy, that is, banking crises necessitate government intervention, often through borrowing, which in turn exacerbates the sovereign debt burden. This finding confirms earlier findings by researchers such as [Eijffinger and Karataş \(2023\)](#) and [Reinhart and Rogoff \(2009\)](#). Thus, the finding in Ghana, suggest that Ghana's banking crises usually herald and aggravate sovereign debt crises.

4.2.2. Impact of banking crisis and selected macroeconomic variables on Ghana's public debt

The most important variable of the study was the banking crisis and its effect on Ghana's sovereign debt levels. We report that Ghana's banking crisis increases Ghana's sovereign debt. During the financial crisis of Ghana, the government provided financial support or bailouts to banks, through liquidity support and deposit guarantees, to prevent a total collapse of the banking sector. This intervention necessitated that the government of Ghana makes substantial public funds available to these financial institutions leading to increased government spending.

Also, the banking crisis led to the loss of investor confidence which implies a higher cost of borrowing and higher interest rates on government bonds. The government of Ghana, therefore, faced increased borrowing costs as investors demanded higher premiums for the perceived risk especially after the rating agencies downgraded the Ghanaian economy to a junk status. There was also serious capital flight as some investors withdrew their capital from the country and moved their businesses to neighbouring countries. This required further borrowing to stabilize the economy. Furthermore, Ghana's banking crisis triggered an economic downturn, as businesses struggled, unemployment levels increased, and consumer spending dropped, all leading to a reduction in tax revenues. This finding is in line with those reported by [Eijffinger and Karataş \(2023\)](#).

4.2.3. Macroeconomic variables and public debt level

This paper shows that growth of real GDP growth results in a decline of Ghana's public debt. The increase in Ghana's real GDP implies an increase in economic growth which typically results in higher government revenue through tax collection and reduction in government's borrowing. This finding is similar to those reported by [de Soyres et al. \(2022\)](#) highlights a negative relationship between real GDP and sovereign debts.

Also, the private sector credit increases Ghana's sovereign debts since the government sometimes guarantees a portion of private sector loans. Hence, an increase in Ghana's private sector credit increases Ghana's government contingent liabilities. This finding confirms those reported by [Asravor et al. \(2023\)](#) which shows that an increase in public

debt levels does not crowd out private-sector credits. Furthermore, a rise in the banking industry loan-to-deposit ratio (LD) helps reduce sovereign debt by stimulating private-sector credit and boosting economic growth. Increased business lending enhances productivity, generating higher tax revenues and reducing reliance on government borrowing. Prioritising private-sector loans over government securities support job creation and investment, strengthening Ghana's economic fundamentals.

Currency depreciation in Ghana ease sovereign debt burdens for local-currency-denominated obligations but increases the local currency cost of external debt. When we focus on cedis denominated debts, then our answer point to the fact that depreciation often leads to inflation, reducing the real value of money and lowering the effective cost of repaying domestic debt. When it comes to international trade, the currency depreciation enhances export competitiveness, potentially increasing foreign exchange earnings and tax revenues, which can be directed toward debt servicing. However, depreciation increases the local currency cost of external debt, potentially worsening repayment challenges. Effective debt management and export promotion are critical to maximizing these potential benefits.

5.1. Diagnostics and robustness checks

To enhance the reliability of our findings, we conducted additional tests after estimating the model. First among these is the Ramsey RESET test, presented in [Table 6](#), which assesses the correctness of the model specification. There is no substantial empirical support to posit the presence of omitted variables or functional form misspecification in the model, as per the results of the Ramsey RESET test. Also, there is insufficient compelling evidence to indicate the presence of heteroscedasticity in the residuals, as determined by the Breusch-Pagan ([Table 6](#)).

The presence of serial correlation within the residuals of the regression model is considered lacking using the Breusch-Godfrey Serial Correlation LM test.

The recursive CUSUM is presented in [Figs. 2](#) and [4](#) depict the results of the CUSUM for models without covariates and with covariates, respectively whilst [Figs. 3](#) and [5](#) present the CUSUM Square tests for

Table 6
Diagnostic test and Sensitivity analysis.

	Test statistic	Value	Model without Covariate	Model with Covariate
Functional forms	Ramsey	F-Statistics	1.1708	0.4712
	Reset	(Prob.)	(0.30100)	(0.79000)
Heteroskedasticity	Breusch-Pagan	F-Statistics	0.2729	0.8631
	Godfrey Test	(Prob.)	(0.96400)	(0.61020)
Serial Correlation	Breusch-Godfrey	F-Statistics	0.6466	0.5583
		(Prob.)	(0.54260)	(0.39085)

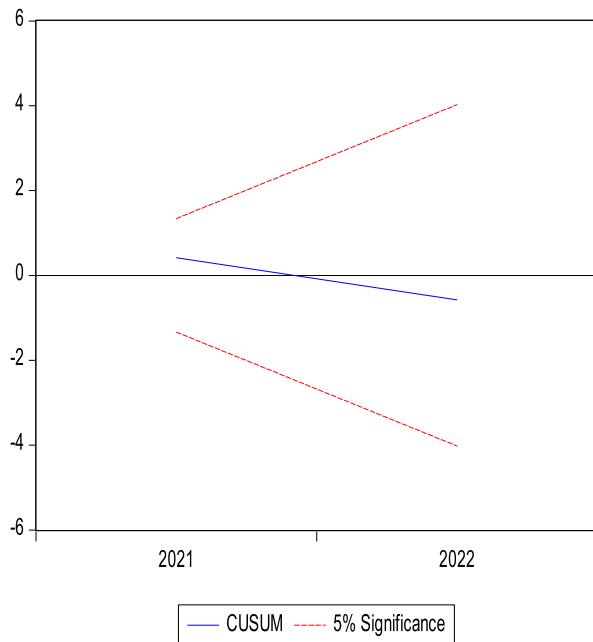


Fig. 2. Cumulative sum (CUSUM Test).

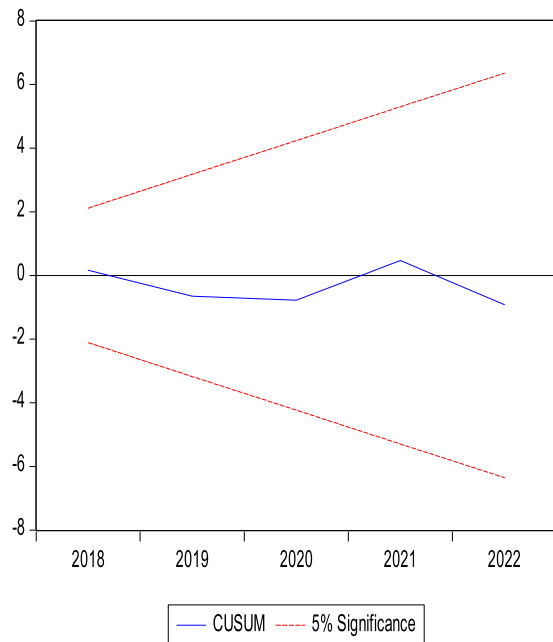


Fig. 4. Cumulative sum (CUSUM Test).

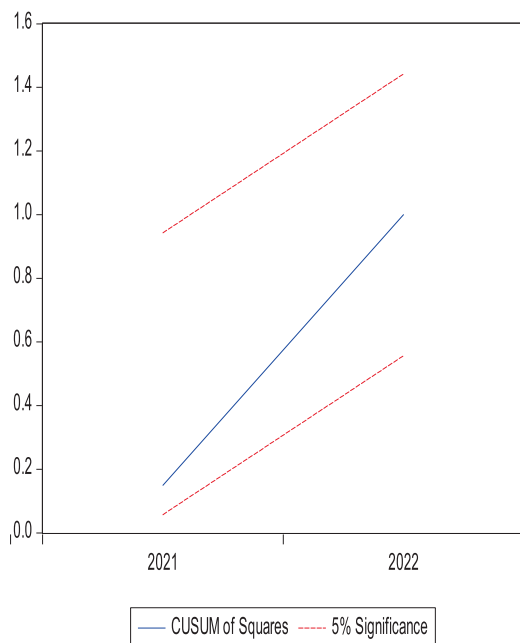


Fig. 3. Cusum of Squares Test.

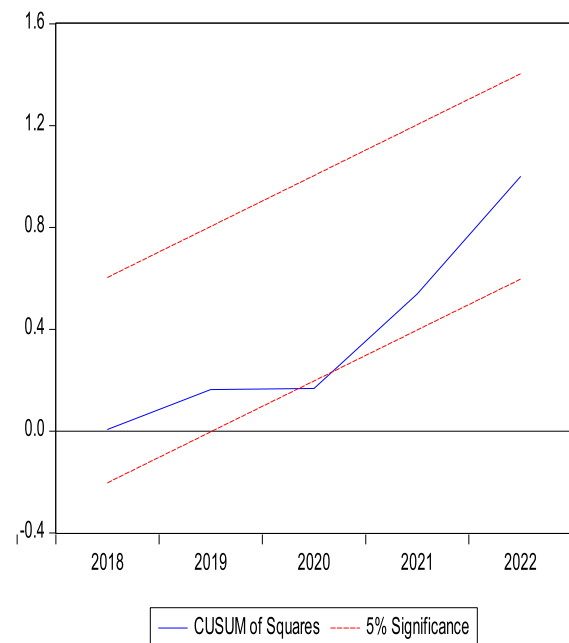


Fig. 5. Cusum of Squares Test.

models with and without covariates. The results show that the graphs remain within the critical boundaries at a 5 % significance level. This indicates that the estimated coefficient parameters of the ARDL model are stable. The diagnostic tests confirm the stability of the model, suggesting its suitability for policy-related decision-making. Also, the variance inflation factor shows that there is no incidence of multicollinearity among the independent variables and the dependent variables.

6. Conclusion

The objective of this study was to investigate the relationship between banking crisis and public debt levels in Ghana. By employing the

ARDL to the secondary data spanning 1997 to 2022, the study concludes that bank crisis has a higher and positive influence on Ghana's sovereign debts. Thus, the banking crisis in Ghana significantly increases the country's sovereign debt levels due to the need for government bailouts and the economic downturn that reduces tax revenues leading to a cycle of increased borrowing costs and financial instability. Also, an increase in real GDP reduces Ghana's sovereign debt. Currency depreciation reduces Ghana's cedis sovereign debt burden by lowering the real value of local debt and boosting export competitiveness. However, it poses challenges for external debt repayment due to increased local currency costs. Also, expanding the banking industry's loan-to-deposit ratio enhances private-sector lending and reduces reliance on government borrowing.

To mitigate the impact of the banking crisis on sovereign debt, the study recommends the strengthening of the financial sector regulations and enhancing institutional frameworks to support long-term economic stability and debt sustainability. Also, the government of Ghana should prioritize export diversification to enhance foreign exchange earnings while using the proceeds strategically for debt servicing. Effective debt management strategies, including limiting reliance on external borrowing, are important to mitigate the adverse effects of currency depreciation on external debt. The study encourages optimal loan-to-deposit ratios to balance private-sector credit growth and fiscal discipline while maintaining financial stability. Also, the significant granger causality from banking crises to sovereign debt levels shows the critical interdependencies between financial sector health and macroeconomic stability. This reinforces the need for a stable banking environment to prevent the amplification of sovereign debt burdens.

CRedit authorship contribution statement

David Marfo-Ahenkorah: Writing – review & editing, Writing – original draft, Visualization, Software, Resources, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Richard Kofi Asravor:** Writing – review & editing, Software, Methodology, Validation, Formal analysis, Investigation. **Nicholas Asare:** Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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